CLAIMS

1   1. A method for enabling a server configured with a plurality of virtual servers to par-

2   ticipate in a plurality of private network address spaces and service requests within those

3   address spaces, the method comprising the steps of:

4   associating each virtual server with an IPspace having one or more addresses as-

5   signed to one or more network interfaces of the virtual server;

6   tagging each network interface with a first IPspace identifier (ID);

7   providing the virtual server with one or more routing tables that control routing

8   operations for requests processed by the virtual server; and

9   applying the first IPspace ID to translation procedures that enable selection of a

10   current virtual server context used to process an incoming request and an appropriate

11   routing table used to process an outgoing request.

1   2. The method of Claim 1 wherein the server is a filer and wherein the virtual server is a

2   virtual filer (vfiler).

1   3. The method of Claim 2 wherein the step of applying comprises the step of employing

2   an incoming path translation procedure.

1   4. The method of Claim 3 wherein the step of employing comprises the steps of:

2   receiving the incoming request at the network interface, the incoming request hav-

3   ing a destination address;

4   searching a list of addresses contained in an interface network structure for an ad-

5   dress that matches the destination address of the incoming request, the interface network

6   structure storing the first IPspace ID; and

7   upon finding a match, following a first pointer of the interface network structure

8   to an interface address structure having a back link pointer that references a vfiler context

9   structure storing a second IPspace ID.

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1   5. The method of Claim 4 wherein the step of employing further comprises the steps of:

2   comparing the first IPspace ID with the second IPspace ID; and

3   selecting the current vfiler context to process the incoming request when the first

4   IPspace ID matches the second IPspace ID.

1   6. The method of Claim 5 wherein the step of employing further comprises the step of

2   configuring a second pointer of a process block data structure to reference the current

3   vfiler context to thereby qualify the request for subsequent processing in the filer.

1   7. The method of Claim 6 wherein the subsequent processing comprises one of searches

2   and boundary checks needed to verify that the vfiler is allowed to access requested stor-

3   age resources.

1   8. The method of Claim 3 wherein the step of applying comprises the step of employing

2   an outgoing path translation procedure.

1   9. The method of Claim 8 wherein the step of employing comprises the steps of:

2   issuing the outgoing request from a vfiler;

3   determining whether the request requires route calculation; and

4   if route calculation is required, using a routing table pointer of the current vfiler

5   context to choose the appropriate routing table of the vfiler to process the outgoing re-

6   quest.

1   10. The method of Claim 9 wherein the step of choosing comprises the steps of:

2   performing a lookup operation to the appropriate routing table;

3   determining over which output interface the outgoing request should be for-

4   warded; and

5   forwarding the request to the output interface.

1 11. A system adapted to enable a file server configured with a plurality of virtual servers
2 to participate in a plurality of private network address spaces and service requests within
3 those address spaces, the system comprising:
4   a network adapter including at least one network interface configured to receive
5 an incoming request from the network and to forward an outgoing request over the net-
6 work, the network interface an address and having a first IPspace identifier (ID) that
7 binds the interface to an IPspace;
8   a plurality of routing tables maintained by the virtual servers to control routing
9 operations for requests processed by the virtual servers;
10   an operating system comprising networking code that uses a destination address
11 of the incoming request and the first IPspace ID to select a current virtual server to proc-
12 ess the incoming request, the networking code further using a routing table pointer of the
13 current virtual server to select an appropriate routing table if a routing operation is re-
14 quired for the outgoing request; and
15   a processor coupled to the network adapter and configured to execute the operat-
16 ing system to thereby invoke network and storage access operations in accordance with
17 translation procedures associated with incoming and outgoing requests.

1 12. The system of Claim 11 wherein the file server is a filer and wherein the virtual serv-
2 ers are virtual filers (vfilers).

1 13. The system of Claim 12 wherein the operating system is a storage operating system.

1 14. The system of Claim 13 further comprising a memory adapted to maintain various
2 data structures that cooperate to provide an IPspace database that stores configuration in-
3 formation used to select the current vfiler.

1 15. The system of Claim 14 wherein the various data structures comprise:
2   an interface network (ifnet) structure associated with the network interface;

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3 an interface address (ifaddr) structure coupled to the ifnet structure and represent-

4 ing the address of the interface;

5 a vfiler context structure coupled to the ifaddr structure; and

6 a process block (proc) structure coupled to the vfiler context structure.

1 16. The system of Claim 15 wherein the ifnet structure includes configuration informa-

2 tion such as a first pointer referencing the ifaddr structure for the address assigned to the

3 network interface and the first IPspace ID of the interface.

1 17. The system of Claim 16 wherein the ifaddr data structure includes a back link pointer

2 that references the vfiler context structure associated with the address.

1 18. The system of Claim 17 wherein the vfiler context structure contains configuration

2 information needed to establish the current vfiler, the configuration information including

3 a second IPspace ID and the routing table pointer.

1 19. The system of Claim 18 wherein the proc data structure represents a context of a pro-

2 cess thread executing on the filer and contains a second pointer referencing the current

3 vfiler.

1 20. Apparatus for enabling a filer configured with a plurality of virtual filers (vfilers) to

2 participate in a plurality of private network address spaces and service requests within

3 those address spaces, the apparatus comprising:

4 means for associating each vfiler with an IPspace having one or more addresses

5 assigned to one or more network interfaces of the vfiler;

6 means for tagging each network interface with a first IPspace identifier (ID);

7 means for providing the vfiler with one or more routing tables that control routing

8 operations for requests processed by the vfiler; and

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9   means for applying the first IPspace ID to translation procedures that enable se-

10   lection of a current vfiler context used to process an incoming request and an appropriate

11   routing table used to process an outgoing request.

1   21. A computer readable medium containing executable program instructions for ena-

2   bling a filer configured with a plurality of virtual filers (vfilers) to participate in a plural-

3   ity of private network address spaces and service requests within those address spaces,

4   the executable program instructions comprising program instructions for:

5   associating each vfiler with an IPspace having one or more addresses assigned to

6   one or more network interfaces of the vfiler;

7   tagging each network interface with a first IPspace identifier (ID);

8   providing the vfiler with one or more routing tables that control routing operations

9   for requests processed by the vfiler; and

10   applying the first IPspace ID to translation procedures that enable selection of a

11   current vfiler context used to process an incoming request and an appropriate routing ta-

12   ble used to process an outgoing request.